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The Transmission of World Shocks to Emerging-Market Countries: An Empirical Analysis

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The views expressed in this paper are those of the author.
No responsibility for them should be attributed to the Bank of Canada.

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Abstract

The first step in designing effective policies to stabilize an economy is to understand business cycles. No country is isolated from the world economy and external shocks are becoming increasingly important. The author documents the sources of macroeconomic fluctuations in 22 emerging-market countries, and measures two specific shocks that could be transmitted from one country to another: a world real output shock and a world real interest rate shock. Her analysis shows that there are major differences in the transmission mechanism across emerging-market countries. To assess whether they are due to different economic structures or to the exchange rate regime, she divides the sample into groups of countries. The results indicate that the exchange rate regime is a critical factor, although restrictions on capital flows also play a crucial role. The author also shows that regional groups and trade openness do not play as important a role as the exchange rate regime and capital flows in determining the transmission of business cycles.

JEL classification: E32, F02, E61, E30
Bank classification: International topics; Exchange rate regimes; Transmission of monetary policy

Résumé

Pour élaborer des politiques efficaces et stabilisatrices, il importe d'abord de comprendre le cycle économique. Aucun pays n'est coupé de l'économie mondiale, et les chocs externes ont aujourd'hui une influence de plus en plus grande. L'auteure examine les sources des fluctuations macroéconomiques qu'ont connues 22 pays à marché émergent. Elle s'intéresse en particulier à deux chocs mondiaux dont les effets sont susceptibles de se propager entre pays : une variation de la production réelle et une modification des taux d'intérêt réels. Son analyse révèle que le mécanisme de transmission présente des différences importantes d'une économie émergente à l'autre. Aussi l'auteure divise-t-elle son échantillon de pays en plusieurs groupes afin d'établir si ces différences sont attribuables à la structure économique des pays étudiés ou à leur régime de change. Ses résultats indiquent que le choix du régime de change est crucial, encore que les restrictions fixées aux mouvements de capitaux jouent également un rôle déterminant. L'étude montre par ailleurs que les blocs régionaux et l'ouverture des échanges sont des facteurs relativement moins importants dans la transmission des fluctuations cycliques que le régime de change et les mouvements de capitaux.

Classification JEL : E32, F02, E61, E30
Classification de la Banque : Questions internationales; Régimes de taux de change; Transmission de la politique monétaire

1. Introduction

The first step in designing effective policies to stabilize an economy is to understand business cycles (Lucas 1977). The central stylized fact of an international business cycle is that when one country's output is above (below) its trend, the output of many other countries also tends to be above (below) their trend. No country is isolated from the world economy and external shocks are becoming increasingly important. With the accelerating pace of globalization, the question of how different countries react to different shocks has gained heightened significance.

The study of co-movement, or integration, is important because its results can guide policy in an era of accelerating globalization. This paper identifies the channels of business cycle transmission to evaluate the extent to which economic fluctuations in the emerging-market (EM) countries are caused by shocks that originate in industrialized countries.

The paper documents the sources of macroeconomic fluctuations in EM countries (focusing on Asia and Latin America) by measuring the relative importance of domestic and external shocks. Previous studies have typically examined only industrialized countries. Although there is no a priori reason to believe that business cycles are transmitted differently to industrialized and EM countries, there could be interesting differences in the way EM countries import business cycle disturbances. The reults of this study on EM countries could help policy-makers design more appropriate policies for those countries. For example, this paper helps explain the relative importance of the different shocks that drive output and real exchange rate fluctuations in EM countries. Consistent with the Mundell-Fleming model, two specific shocks are measured that could be transmitted from one country to another: a world real output shock and a world real interest rate shock. To assess whether the discrepancies in the transmission of shocks among countries is due to different economic structures or to the exchange rate regime, this paper divides the sample into groups of countries, based on the region to which a country belongs, its openness to trade, its exchange rate regime, and its capital flows.

This paper contributes to the literature in three ways. First, country characteristics are used to determine the source of the divergent responses to shocks for the different EM countries. Second, the sample analyzed contains 22 EM countries, considerably more than is typically found in the literature.[1] Third, this paper treats world variables as being exogenous, considering all EM countries to be small open economies.

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1. For example, Hoffmaister and Roldós (1996) examine the case of Brazil and Korea, Kydland and Zarazaga (1997) analyze the case of Argentina, and Rodriguez-Mata (1997) studies economic fluctuations in Costa Rica.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature. Section 3 presents the empirical framework and section 4 provides details on the data and the specification of the model. Section 5 summarizes the results and presents the different groups of countries. Section 6 concludes.

2. Review of the Literature

There is a substantial literature on the transmission of business cycles. As well, the idea that fluctuations in the developing South are caused largely by shocks that originate in the industrialized North is widely studied in the traditional North–South literature. The basis of the argument is that the South specializes in the production of primary goods and therefore relies on the North for its manufactured goods and for demand for its primary output. Kouparitsas (1996) builds a general-equilibrium model of North–South trade and finds that it contains a strong mechanism for the transmission of business cycles from one region to the other. In his model, 70 per cent of the variation in Southern consumption is caused by Northern aggregate output.

The most commonly used empirical framework in the literature is a small open-economy version of the structural vector autoregression (SVAR) model proposed by Blanchard and Quah (1989). The SVAR model adds economic restrictions to an otherwise statistical model to identify the sources of macroeconomic fluctuations. SVARs are widely used, because they provide an appropriate framework in which to examine the transmission of shocks. Researchers can identify the relevant shocks and describe the response of the system to shocks by analyzing impulse responses (the propagation mechanism of the shocks) as well as variance decompositions.

Using the empirical framework identified above, Hoffmaister and Roldós (1997) compare business cycles in Asia and in Latin America using panel data. They confirm the stylized facts that earlier studies have found for the U.S. economy: the main source of output fluctuations is domestic supply shocks, even in the short run.[2] External factors account for approximately 20 per cent of output movements. Hoffmaister and Roldós also conclude that, in Latin America, external shocks (particularly world interest rate shocks[3]) and demand shocks affect output fluctuations more than in Asia.

Other studies analyze stylized features of macroeconomic fluctuations. For example, Agénor, McDermott, and Prasad (2000) find that there are many similarities between macroeconomic

2. Similar conclusions are reached in Hoffmaister and Roldós (1996), which analyzes Brazil and Korea.
3. This is consistent with the important role that Calvo, Leiderman, and Reinhart (1994) assign to world interest rate shocks.

fluctuations in EM and industrialized countries, as well as important differences. Some of the studies focus on specific stylized facts and then construct theoretical models that can replicate those facts; e.g., Kydland and Zarazaga's (1997) work on Argentina and Rodriguez-Mata's (1997) analysis of fluctuations in Costa Rica. In all studies, industrialized countries are found to have a significant impact on EM economies. For example, a study by the International Monetary Fund (IMF 2001) shows that a 1 per cent change in G-7 growth is associated with a 0.4 per cent change in growth in developing countries. Their results also show that a 1 per cent fall in world real interest rates translates into a 0.3 per cent increase in the growth of developing countries. However, most of the studies based on stylized facts focus on unconditional correlations between different variables (e.g., output, exchange rates, and prices). In such a framework, the unconditional correlations may be small, because they average the effects of different types of shocks. It is therefore important to develop and estimate a structural model.

3. Empirical Framework

This section describes the empirical framework used in this study. Most previous researchers follow the SVAR model proposed by Blanchard and Quah (1989).[4] It is useful because it relies on long-run restrictions that stem from economic theory. In this study, however, the short-run dynamics are unrestricted, and therefore the empirical framework chosen differs by treating the world aggregates as being exogenous. Consequently, EM countries have no impact on world variables in the long run or the short run.

The empirical model permits an assessment of the importance of external shocks relative to domestic shocks in explaining macroeconomic fluctuations in EM countries. The world aggregates are treated as being exogenous and the EM countries' domestic variables are treated as being endogenous. The foreign shocks are identified by a small-economy assumption. The implication of using such a framework is that domestic variables are not allowed to affect world aggregates in the short run or the long run. This framework is realistic because the analysis considers EM countries.

The structural form of the model is:

$$A_0 y_t = (B_0 x_t + A_1 y_{t-1} + u_t), \tag{1}$$

where x_t is a vector of exogenous variables (i.e., world real output and interest rates), y_t is a vector of endogenous variables (i.e., domestic real output, real exchange rate, domestic prices), A_0 represents the contemporaneous relations among the variables, A_1 is a matrix finite-order lag

4. This methodology is also proposed by Shapiro and Watson (1988), and extended to large open economies by Clarida and Galí (1994).

polynomial, and u_t is a vector of disturbances. The structural model is not directly estimable. The reduced form, however, is obtained by multiplying equation (1) by A_0^{-1}:

$$y_t = \left(A_0^{-1} B_0 x_t + A_0^{-1} A_1 y_{t-1} + A_0^{-1} u_t \right), \tag{2}$$

$$y_t = (C_0 x_t + C_1 y_{t-1} + e_t), \tag{3}$$

where the e's are the reduced-form innovations with zero mean and $E[ee'] = \Omega$.

Equation (3) can be used to obtain the vector moving-average representation:

$$y_t = \sum_{i=0}^{\infty} C_1^i C_0 x_{t-i} + \sum_{i=0}^{\infty} C_1^i e_{t-i}, \tag{4}$$

where $C_1^i = A_0^{-1} A_1$ and $C_0 = (A_0^{-1} B_0)^i$.

The following impulse responses are analyzed:

$$\frac{\partial y_t}{\partial x_t} = C_0 \qquad \text{and} \qquad \frac{\partial y_t}{\partial x_{t-i}} = C_0 C_1^i. \tag{5}$$

Throughout this paper, impulse responses trace the response of current and future values of each of the variables to a one-unit increase in the current value of the exogenous variables.

4. Data and Specification of the Model

To analyze the sources of fluctuations in the real exchange rate and real per capita output in EM countries, several specifications of the model are examined. This section describes the data used and the specification of the benchmark model.

4.1 Data sources

The data consist of annual observations from 1970 through 2002 for 22 EM countries: 13 Latin American and 9 Asian economies are examined (see the country list in the appendix). Most data series are taken from the International Financial Statistics (IFS): (i) domestic per capita output is measured as GDP at 1995 prices (line 99b divided by 99bipzf)[5]; (ii) the real exchange rate is calculated as the relative price of non-traded goods in terms of traded goods, proxied by the ratio

5. Data on population are taken from the World Bank database, line SP.POP.TOTL.

of the CPI (line 64) divided by the product of the nominal exchange rate (line rf) and the PPI (line 63) of the United States[6]; the domestic price level is measured by the CPI.

The G-7 economies are used as a proxy for world aggregates. World real GDP is a sum of the G-7 economies (line 99b.czf/99birzf, converted into U.S. dollars using line rf.zf...h from the IFS). The world interest rate is an average over the G-7 countries (treasury bill rate, line 60c).[7] The time-varying weights used in this average are based on each country's share of real GDP in the total. The real interest rate is obtained by subtracting CPI inflation from the interest rate of each of the G-7 countries.

4.2 Time-series properties

The modelling techniques used assume that all the series are stationary, and that levels of these series are not cointegrated. These assumptions are supported by the data. Augmented Dickey-Fuller (ADF) tests are performed on all of the series[8] for all of the countries in the sample, and the null hypothesis of a unit root cannot be rejected.[9] It appears, however, that the first differences of these series are stationary. As well, Johansen's test of cointegration suggests that there is no evidence of cointegration (the null hypothesis of zero cointegration vectors (r=0) is not rejected).[10]

4.3 Specification of the VAR

The shocks in the model fit nicely with the transmission process in the Mundell-Fleming framework. Therefore, the most important channels through which shocks are transmitted are world real output and the real interest rate.

The specification of the benchmark model is as follows. The vector of endogenous variables includes the first difference of the log of real per capita output as well as the first difference of the log of the real exchange rate for each of the 22 EM countries. Based on the Akaike Information Criterion (Akaike 1973) and the Schwarz Criterion (Schwarz 1978), two lags of each endogenous variable are included in the VAR. As well, the VAR includes two exogenous variables: world real

6. This consumption-based real exchange rate is used by many authors; for example, Hoffmaister and Roldós (1997).
7. Data for Japan are from the BIS database.
8. The series consist of world real GDP, world real interest rate, domestic real GDP, and the real exchange rate.
9. There are three exceptions. The null hypothesis of a unit root in the real exchange rate is rejected for Bangladesh, Thailand, and the Philippines. However, the same specification will be imposed for all countries.
10. The results are available from the author.

output and world real interest rate. The first differences of those series are included contemporaneously in the model.

For each country in the sample, the benchmark model is constructed to help explain the transmission of shocks from industrialized to EM economies. As well, to compare the way in which EM countries respond to shocks with the way in which industrialized countries respond to them, the same empirical framework will be used for a control group of industrialized countries that are small open economies (Canada, the United Kingdom, and Australia). This permits an assessment of whether the response to shocks in EM countries is any different than in industrialized small open economies; previous studies do not make this assessment.[11]

5. Results

This section describes the impulse-response functions (IRFs) obtained with the benchmark model and contrasts them with the results for the control group. Different groups of countries are compared in section 5.2; this comparison is the most promising way to understand the discrepancies in the response of domestic variables to external shocks. A sensitivity analysis is also performed.

5.1 Benchmark model

To assess the response of domestic variables to world shocks for different EM countries, IRFs are used. They represent the reaction of each variable to shocks in the different equations of the system. Across all 22 countries, the response of the domestic variables is different; no clear pattern can be discerned. Only two general conclusions can be drawn (Figures 1 and 2). First, the domestic variables (real per capita output and real exchange rate) respond similarly to domestic shocks across the sample. Second, for a substantial fraction of the sample, the initial impact of a domestic shock is larger than that of a world shock.

But the similarities across the sample end here. The conclusions regarding the propagation mechanism following an external shock are not as obvious. There are important divergences across the sample. As well, the EM countries analyzed demonstrate a different adjustment to shocks than the control group of industrialized countries (see Figure 3 for the IRF of the United Kingdom, which is representative of the industrialized country group). Indeed, the adjustment to shocks is more erratic in EM countries. No major conclusions can be drawn regarding the similarity of the transmission of shocks. Therefore, the particular responses of EM countries do

11. Other studies focus on industrialized countries, but, to the author's knowledge, there has never been a study that analyzes the transmission of shocks of industrialized and EM countries within the same empirical framework.

not stem only from the fact that they are small open economies: they respond differently than industrialized small open economies. Other characteristics must explain their particular responses.

The responses of domestic variables to world shocks vary markedly across the countries studied (see Figures 1 and 2). Four groups of countries are studied to assess whether these differences are a result of different economic structures (i.e., openness to trade and capital flows) or a result of differences in exchange rate regimes. Section 5.2.2 reports on this assessment; it is the most important contribution this paper makes to the literature.

5.2 Country groupings

In an attempt to explain the discrepancies between the response of domestic variables (real output per capita and real exchange rate) to external shocks, four groups of countries are used. First, because the different responses could be caused by factors that are specific to the different regional groups, this paper investigates whether the response is similar among Asian and Latin American countries. Whether the exchange rate regime can cause the different patterns observed across EM countries is also examined, as well as the size of each country's trade sector and the level of each country's capital flows.

5.2.1 Regional groups

The macroeconomic experiences of the EM countries in Latin America and Asia during the past 25 years have differed markedly. The two regions have different inflation rates, savings rates, and fiscal responsibilities. It is therefore plausible that the different characteristics of the IRFs derive from the dissimilarities between the two regional groups. If so, then common features should be observed within Asian and Latin American countries as well as discrepancies between the two regional groups.

Figures 4 and 5 show the average IRFs of Asian and Latin American countries, respectively. The average responses between regional groups reveal important discrepancies across certain countries, but no clear pattern is apparent within a regional group. The different responses therefore are not caused by the different characteristics of the regional groups. Figures 4 and 5 also show that the response of domestic output to a world output shock is very similar across regional groups. As expected, a world output shock has a positive impact on domestic output, followed by an adjustment, and the impact dies out after six periods.

Another important feature of the model is the response of the real exchange rate to a world interest rate shock. Across countries, there are different responses of the real exchange rate. Dividing the sample into regional groups does not yield a good explanation for this difference. In

many countries, there is the typical response of real depreciation following a world interest rate shock. Indeed, following a positive world interest rate shock, the interest rate differential between the EM countries and the world interest rate widens and capital flows would be expected to move out of the EM countries, thus causing the real exchange rate to depreciate. In some countries, however, the reverse is observed and a real appreciation occurs. This cannot be explained on the basis of the regional group, because there is no clear pattern among Asian or Latin American countries.

It can therefore be concluded that regional groups do not provide a good explanation for the differences among the EM countries for the transmission of shocks. Another potential reason for divergence is the exchange rate regime.

5.2.2 Exchange rate regime

To explain the divergent responses of the real exchange rate to a world interest rate shock, exchange rate regimes are examined. To do so, the IMF's official classification of exchange rate regimes is used, based on self-identification by member countries.[12] Ghosh et al. (1997) use the IMF's data to develop a different classification scheme for 136 countries over the period from 1960 to 1990. They aggregate the nine-regime classification scheme reported by the IMF into a tripartite scheme where exchange rate regimes are classified as either pegged, intermediate, or flexible (Table 1). Their classification scheme is adopted in this paper and their grouping extended to 2002 based on IMF reports (IMF 1990–2002).

Table 1: Tripartite Classification Scheme, Exchange Rate Regime

ER regime classification	IMF classification
Pegged	- Currency boards - Single-currency pegs - Basket pegs
Intermediate	- Crawling pegs - Target zones
Flexible	- Floats with some intervention (but no predetermined range for intervention) - Pure floats

The countries' exchange rate regimes are averaged over 1990–2002. The classification for each country is provided in the appendix.[13]

12. The IMF publishes this classification annually (IMF 1990–2002).
13. A country that has either an intermediate ER regime or is moving from flexible to pegged, and vice versa, would be considered in the analysis to fall under "mixed."

A priori, it is not clear whether the responses to shocks would be larger in a fixed or in a floating exchange rate regime. In a floating exchange rate regime, the exchange rate can absorb some of the adjustment, and the variables might not have to change by as much as they would in a fixed-rate regime. On the other hand, countries that have floating exchange rates (especially if the volatility is very high) may sometimes be regarded as more risky than those that have credible pegs.

Hoffmaister, Roldós, and Wickham (1997) examine the sources of macroeconomic fluctuations in sub-Saharan African countries[14] and find that external shocks appear to have a greater influence on fluctuations of output and the real exchange rate in fixed exchange rate regime countries, because the exchange rate does not (partially) buffer those countries from external shocks.

It is found that the type of exchange rate regime is a critical determinant for the transmission of external shocks. Indeed, the finding described in section 5.2.1, that some countries experience a real appreciation following a world real interest rate shock, can be better understood when considering the exchange rate regime. As Figure 6 shows, countries classified as having a flexible exchange rate exhibit an expected real depreciation when the world real interest rate increases. Countries under a fixed exchange rate regime, however, have a counterintuitive response: they experience a real appreciation.

The model shows that, if a country is under a fixed exchange rate, or if it is considered as having an intermediate exchange rate regime, it will experience a real appreciation following a world interest rate shock. The reason for this counterintuitive reaction is that, since the exchange rate is fixed, the adjustment must come through prices. Consistent with the Mundell-Fleming framework, a world interest rate shock would result in a decline in the domestic price level, as well as a fall in the foreign price level.

Many authors (Agénor and Aizenman 1999, among others) who hypothesize that there are important nominal rigidities in EM countries report numerous distortions and a dualism in the labour market in those countries. This suggests that the domestic price level does not move instantaneously in response to unanticipated disturbances, but adjusts slowly over time. It is therefore possible for the currency to experience a real appreciation, as observed for countries that have a fixed exchange rate or an intermediate exchange rate regime.[15]

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14. Hoffmaister, Roldós, and Wickham (1997) compare the CFA franc countries with the non-CFA franc countries.
15. This could also reflect other factors, such as the nominal exchange rate adjustment with respect to third countries.

In addition, the model suggests that countries under a fixed or a flexible exchange rate regime are less vulnerable following a world real output shock than countries under an intermediate regime. A flexible exchange rate acts as a shock absorber (Figure 7), as expected, since the initial impact and the response of domestic output is rather small. The same is observed for the fixed exchange rate: those countries are more protected from shocks. It can therefore be concluded that a country is more vulnerable to external shocks when it is not at either end of the exchange rate regime spectrum. It is possible, however, that this result occurs because of self-selection, since inherently unstable countries cannot maintain exchange rate regimes at either end of the spectrum. Countries at both ends of the spectrum are therefore more stable by definition.

5.2.3 The size of the trade sector

A third country grouping is considered. The hypothesis to be tested is simple: the more open a country is, the more it should react to foreign variables. Countries that are more open are therefore expected to react more to external shocks. To assess this possibility, countries are divided into two groups: "most" and "least" open. The measure of trade openness is a standard openness ratio (ratio of imports and exports to GDP[16]). If the ratio is higher than the median, the country is considered to be in the more open group. Otherwise, it is considered to be in the least open group.

First, the response of domestic output following an external output shock is examined. As Figure 8 shows, trade openness does not affect the transmission of the shock. Whether the country is in the more or the least open group, the dynamics are the same: a positive world output shock has a positive impact on EM countries.

Figure 9 shows that trade plays a role in the response of the real exchange rate to a world interest rate shock. Indeed, on average, a country that is more open will have the response described in section 5.2.2 (real depreciation), whereas countries that are relatively closed will experience a counterintuitive response (real appreciation). This supports the hypothesis given in section 5.2.2. Most countries that have a fixed exchange rate regime and that experience a real exchange rate appreciation are relatively closed.[17] This reinforces the explanation for the nominal price rigidities, because those countries do not face as much competition through trade.

16. Data on trade are taken from the IFS, line 70..dzf and 71..dzf.
17. Examples of such countries are Argentina and Bangladesh.

5.2.4 Capital flows

The premise of the capital flows grouping is that, if a country has a low level of capital flows across its borders, it will be less affected by world interest rate shocks. To assess this premise, a measure of gross capital flows to GDP is used.[18]

As Figure 10 shows, countries that have restricted capital flows initially react less to a world interest rate shock. Low capital mobility dampens the effect of the foreign shock to the asset markets. This result suggests that, as expected, financial linkages are more important, in terms of transmission of business cycles, for economies that are more open to capital flows. Figure 11 shows that the initial impact of a world output shock on domestic output is smaller for a country that has a low level of capital flows.

The results are in line with stylized facts that, if world interest rates rise after a period of low levels of interest rates and abundant liquidity, countries that have a high level of capital flows are more vulnerable to capital outflows as interest rates in industrialized countries rise. It is therefore consistent with what is observed in the sample that the impact on domestic output is more negative for countries that have more open capital accounts.

Furthermore, it is found that the level of development plays a role in explaining the transmission of shocks. The results show that countries that have higher levels of real GDP per capita are affected negatively by a world interest rate shock, whereas countries that have lower real GDP per capita are affected positively. Countries that have higher levels of development have better-functioning financial systems and therefore borrow more on international capital markets. Although the increase in world interest rates diminishes the relative attractiveness of EM bonds and increases the cost of borrowing, a recovery in industrialized countries also affects emerging markets through the trade channel (resulting from stronger growth in industrialized countries). These offsetting effects will have different impacts on different countries. The results show that, following a world interest rate shock, countries that have higher levels of real GDP per capita are affected more by the financial channel, and countries that have lower real GDP per capita are affected more by the trade channel.

5.3 Sensitivity analysis

To test the robustness of the benchmark model, a sensitivity analysis is performed. The results show that the model is robust to different specifications. For example, when a fifth variable is added to the model (domestic prices), the results described in sections 5.1 and 5.2 still hold.

18. Data on gross capital flows are taken from the World Bank database (line bg.kac.fnei.gd.zs).

Different world aggregates are also considered. World output, as proxied by the G-7 economies, is replaced by U.S. real output, and the U.S. federal funds rate is substituted in place of the world interest rate shock. The adjustment pattern is, in most cases, the same, but the response is higher following a U.S. shock than following a G-7 shock.

6. Conclusion

The study of co-movement is important because its results can guide policy in an era of accelerating globalization. As the latest slowdown of the world economy has demonstrated, business cycles are transmitted across countries. This paper has identified channels of business cycle transmission to evaluate the extent to which economic fluctuations in the EM countries are caused by shocks that originate in industrialized countries.

The sources of macroeconomic fluctuations in EM countries (focusing on Asia and Latin America) have been documented and the relative importance of domestic versus external shocks has been measured. Consistent with the Mundell-Fleming model, two specific shocks were measured that could be transmitted from one country to another: a world real output shock and a world real interest rate shock. The analysis has helped explain the relative importance of the different shocks that drive output and real exchange rate fluctuations in EM countries.

The results obtained show that there are major differences in the transmission mechanism across different EM countries. To assess whether the discrepancies in the transmission of shocks is due to different economic structures or to the exchange rate regime, a sample of 22 EM coutries has been divided into groups, based on the region to which a country belongs, its openness to trade, its exchange rate regime, and its capital flows. The results indicate that the exchange regime is a critical factor, although the restrictions on capital flows also play a crucial role. It has also been shown that the role played by regional groups and trade openness is not as important in determining the transmission of business cycles. When the impact of external shocks on real output and the real exchange rate for EM countries is analyzed, exchange rate regimes as well as restrictions on capital flows that exist in those countries should be the two major factors considered.

This paper has provided a number of preliminary results. Other, more detailed models could be used to further explain the transmission of business cycles, in order to help policy-makers design improved macroeconomic policies in an increasingly integrated world economy.

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Figure 1: Argentina

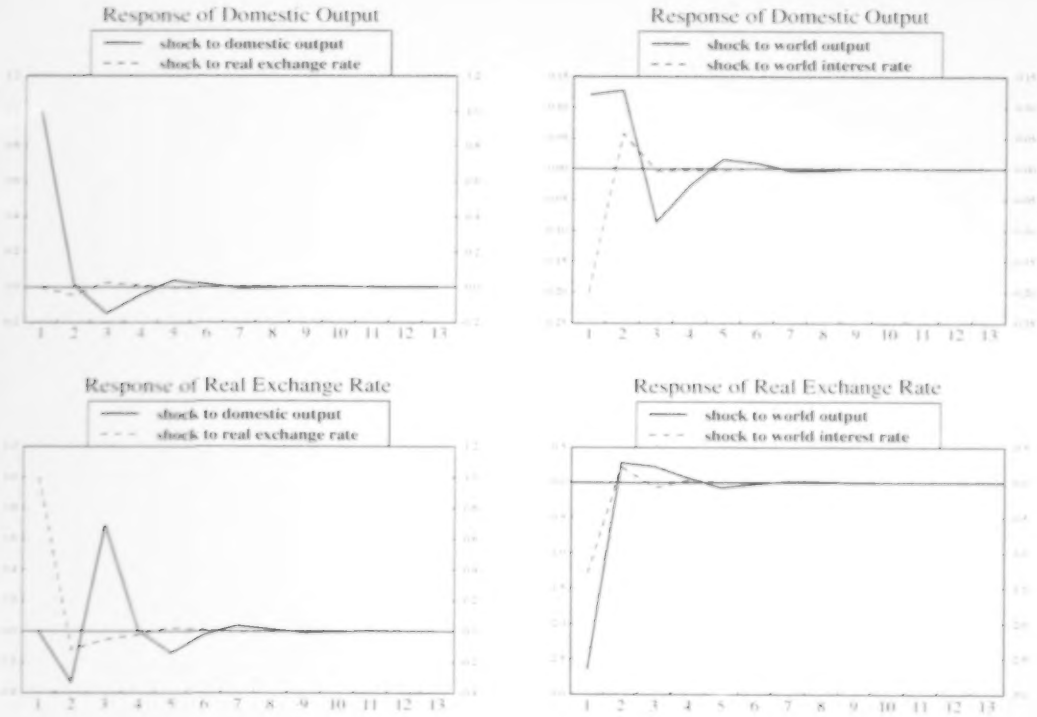
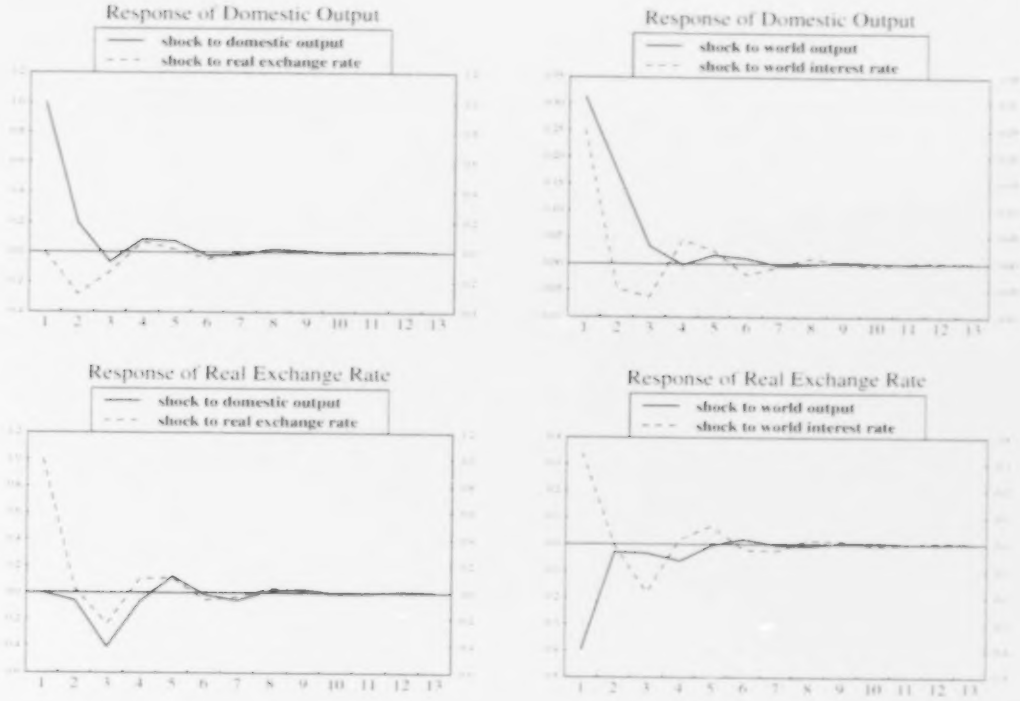

Response of Domestic Output
shock to domestic output
shock to real exchange rate
Response of Domestic Output
shock to world output
shock to world interest rate
Response of Real Exchange Rate
shock to domestic output
shock to real exchange rate
Response of Real Exchange Rate
shock to world output
shock to world interest rate

Figure 2: Thailand


Response of Domestic Output
shock to domestic output
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Response of Domestic Output
shock to world output
shock to world interest rate
Response of Real Exchange Rate
shock to domestic output
shock to real exchange rate
Response of Real Exchange Rate
shock to world output
shock to world interest rate

Figure 3: United Kingdom

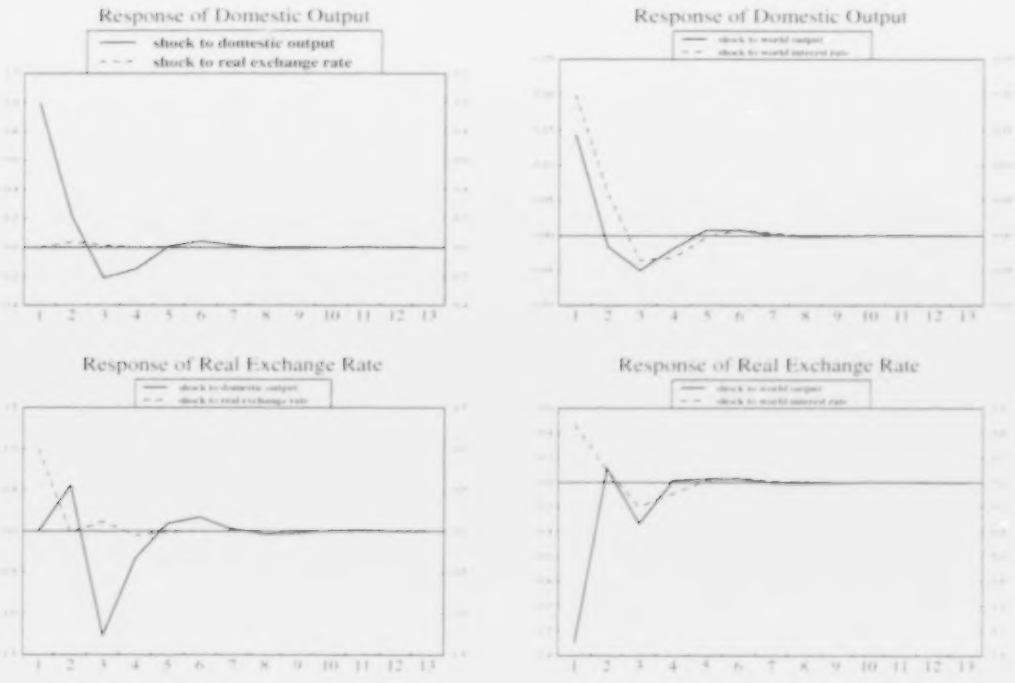

Response of Domestic Output
shock to domestic output
shock to real exchange rate
Response of Domestic Output
Response of Real Exchange Rate
Response of Real Exchange Rate

Figure 4: Asia

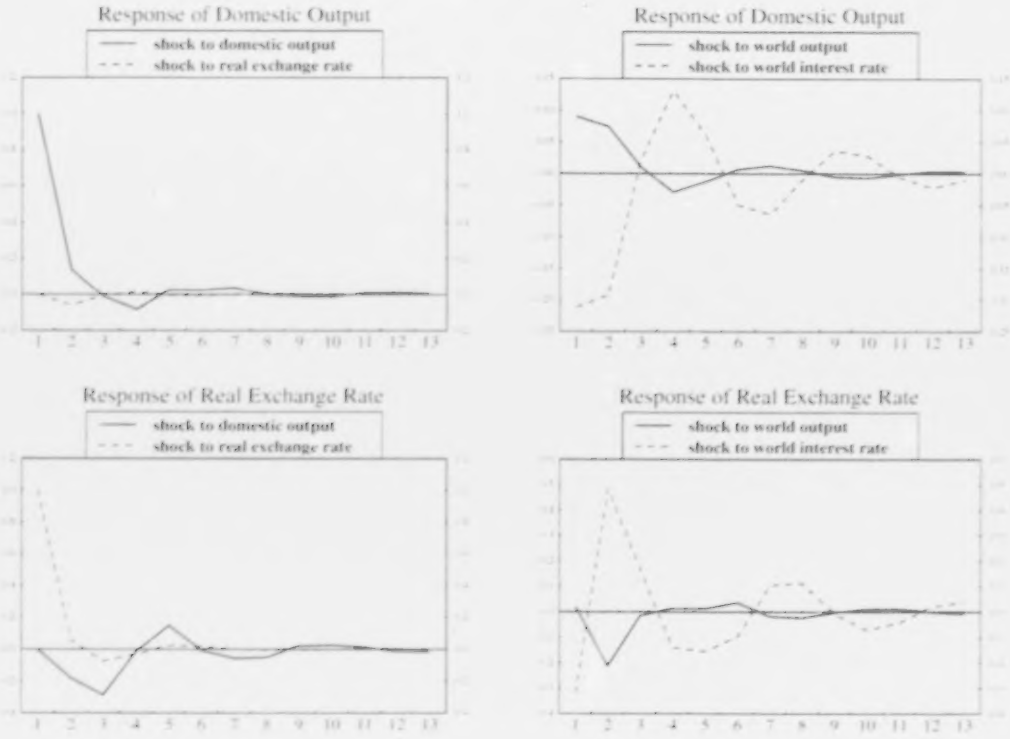

Response of Domestic Output
shock to domestic output
shock to real exchange rate
Response of Domestic Output
shock to world output
shock to world interest rate
Response of Real Exchange Rate
shock to domestic output
shock to real exchange rate
Response of Real Exchange Rate
shock to world output
shock to world interest rate

Figure 5: Latin America

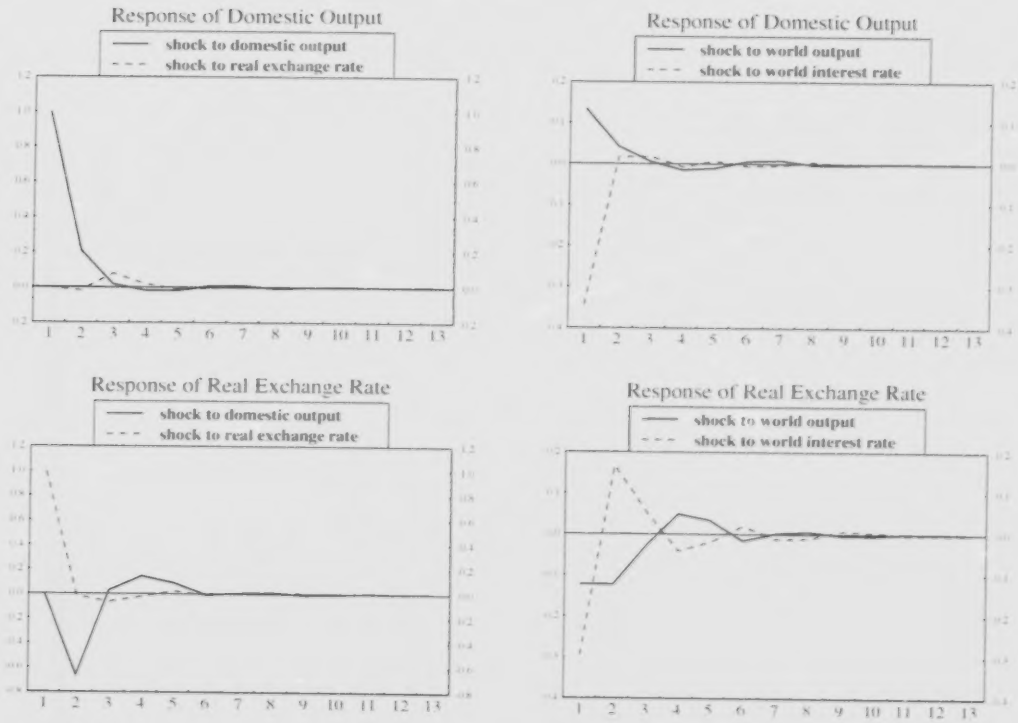

Response of Domestic Output
shock to domestic output
shock to real exchange rate
Response of Domestic Output
shock to world output
shock to world interest rate
Response of Real Exchange Rate
shock to domestic output
shock to real exchange rate
Response of Real Exchange Rate
shock to world output
shock to world interest rate

Figure 6: Exchange Rate Regimes: Response of the Real Exchange Rate

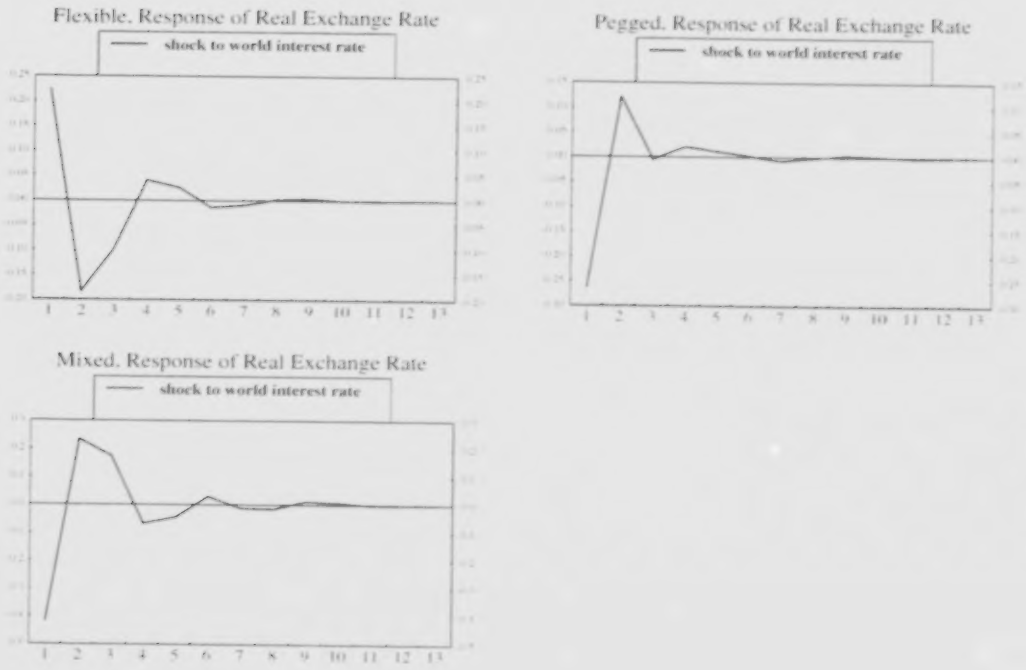

Flexible. Response of Real Exchange Rate
shock to world interest rate
Pegged. Response of Real Exchange Rate
shock to world interest rate
Mixed. Response of Real Exchange Rate
shock to world interest rate

Figure 7: Exchange Rate Regimes: Response of Domestic Output

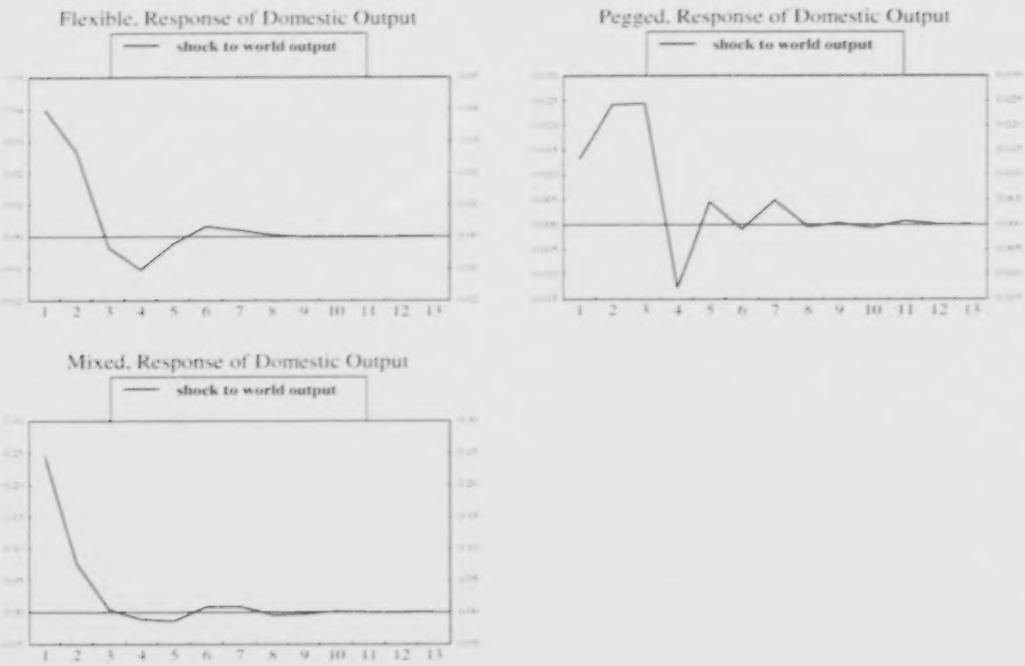

Flexible, Response of Domestic Output
shock to world output
1 2 3 4 5 6 7 8 9 10 11 12 13
Pegged, Response of Domestic Output
shock to world output
1 2 3 4 5 6 7 8 9 10 11 12 13
Mixed, Response of Domestic Output
shock to world output
1 2 3 4 5 6 7 8 9 10 11 12 13

Figure 8: Trade Sector: Response of Domestic Output

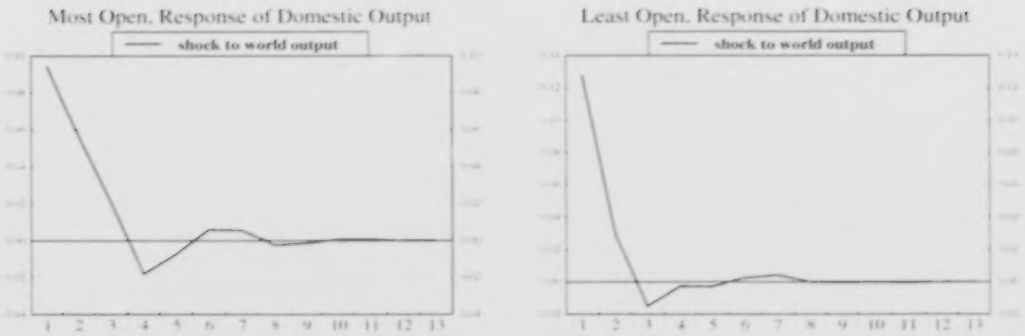

Most Open, Response of Domestic Output
shock to world output
1 2 3 4 5 6 7 8 9 10 11 12 13
Least Open, Response of Domestic Output
shock to world output
1 2 3 4 5 6 7 8 9 10 11 12 13

Figure 9: Trade Sector: Response of the Real Exchange Rate

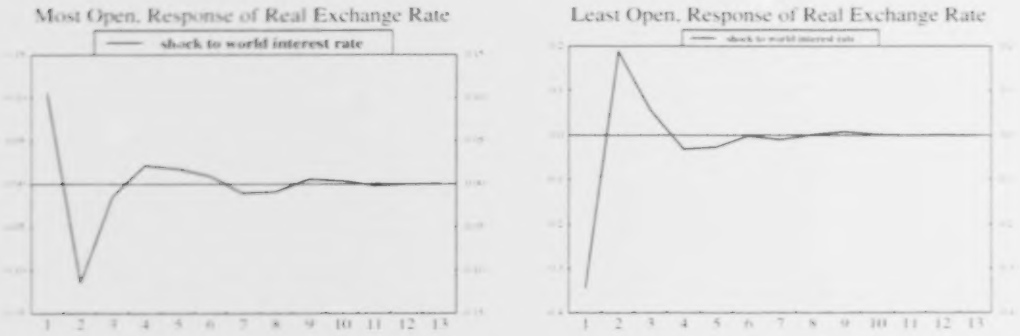


Figure 10: Capital Flows Sector: Response of Domestic Output

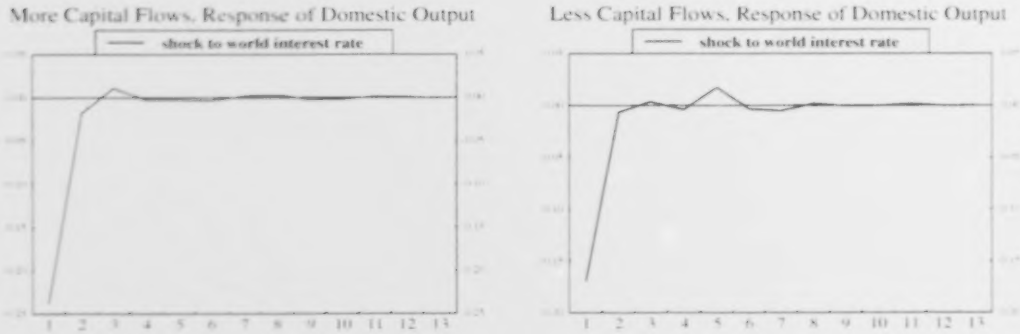
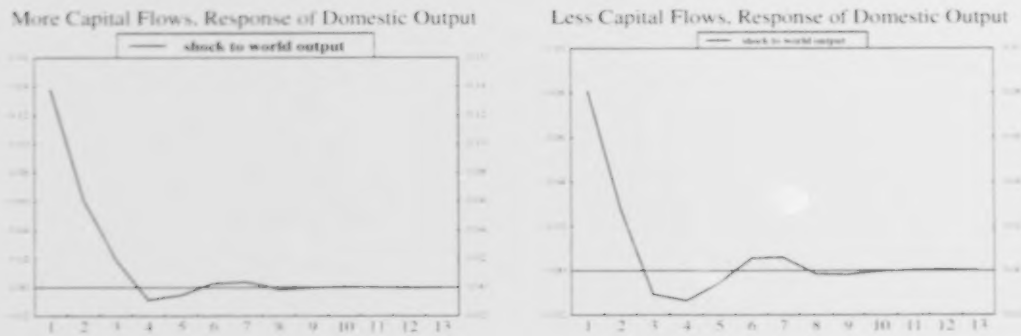

More Capital Flows, Response of Domestic Output
shock to world interest rate
Less Capital Flows, Response of Domestic Output
shock to world interest rate

Figure 11: Capital Flows Sector: Response of Domestic Output



Appendix

Classification of 22 Emerging-Market Countries

	Regional group	Measure of trade openness	Measure of restrictions on capital flows	Exchange rate regime
Argentina	Latin America	Least open	More flows	Pegged
Brazil	Latin America	Least open	Less flows	Mixed
Chile	Latin America	Most open	More flows	Mixed
Colombia	Latin America	Least open	Less flows	Mixed
Costa Rica	Latin America	Most open	Less flows	Mixed
Dominican Republic	Latin America	Most open	Less flows	Flexible
Ecuador	Latin America	Most open	More flows	Pegged
El Salvador	Latin America	Least open	Less flows	Mixed
Guatemala	Latin America	Least open	More flows	Flexible
Mexico	Latin America	Most open	Less flows	Flexible
Peru	Latin America	Least open	Less flows	Flexible
Uruguay	Latin America	Least open	More flows	Mixed
Venezuela	Latin America	Most open	More flows	Mixed
Bangladesh	Asia	Least open	Less flows	Pegged
India	Asia	Least open	Less flows	Flexible
Indonesia	Asia	Most open	Less flows	Flexible
Malaysia	Asia	Most open	More flows	Pegged
Pakistan	Asia	Least open	Less flows	Flexible
Philippines	Asia	Most open	More flows	Flexible
Singapore	Asia	Most open	More flows	Flexible
Sri Lanka	Asia	Most open	More flows	Flexible
Thailand	Asia	Most open	More flows	Mixed

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